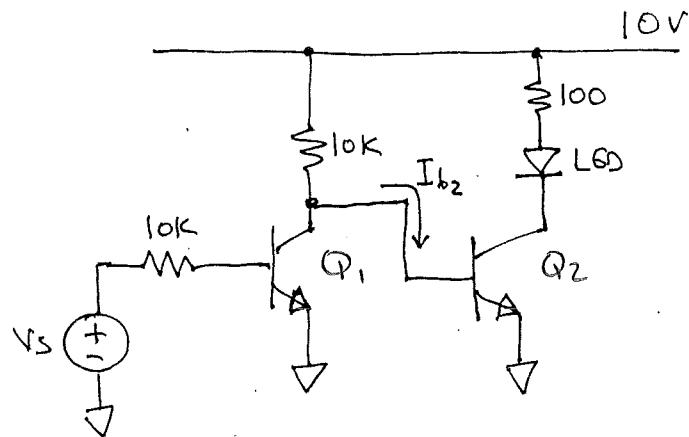


30

Consider the circuit below. Assume  $\beta$  for  $Q_1 + Q_2$  is 100. If  $I_{b2} = 930\mu A$ , what is the LED current and is  $Q_1$  on or off. Assume  $V_{LED(on)} = 2V$ ,  $V_{CE(SAT)} = 0.2V$



If  $I_{b2} = 930\mu A$  &  $Q_2$  is on, then  $I_{c2} = 930\mu A * 100 = 93mA$ . But even if  $Q_2$  was shorted C to E, the current would only be  $\frac{10 - 0.2 - 2.0}{100} = 78mA$ , so  $Q_2$  is saturated & the LED current is 78mA.

If  $930\mu A$  is flowing into  $Q_2$  base, then  $(930 \times 10^{-6})10000$  volts is dropped across the 10k resistor in the collector path of  $Q_1$  which is 9.3 volts. Since  $Q_2$  is on  $V_{BE2} = 0.7$ . Thus no current can be flowing through  $Q_1$  ∵  $Q_1$  is off.